

WITH GRAPH PAPER

केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सैकण्डरी स्कूल परीक्षा (कक्षा दसवीं)
परीक्षार्थी प्रवेश-पत्र के अनुसार भरें

विषय Subject : MATHEMATICS								
विषय कोड Subject Code : 041								
परीक्षा का दिन एवं तिथि Day & Date of the Examination : MONDAY, 03/04/2017								
उत्तर देने का माध्यम Medium of answering the paper : ENGLISH								
प्रश्न पत्र के ऊपर लिखे कोड को दर्शाए Write code No. as written on the top of the question paper :	Code Number 30/3	Set Number <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4						
अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या No. of supplementary answer -book(s) used	0							
विकलांग व्यक्ति : Person with Disabilities :	<input type="checkbox"/> हाँ / नहीं <input checked="" type="checkbox"/> Yes / No	NO						
किसी शारीरिक अक्षमता से प्रभावित हो तो संबंधित वर्ग में <input checked="" type="checkbox"/> का चिह्न लगायें। If physically challenged, tick the category	<table border="1"><tr><td>B</td><td>D</td><td>H</td><td>S</td><td>C</td><td>A</td></tr></table>		B	D	H	S	C	A
B	D	H	S	C	A			
B = दृष्टिहीन, D = मूक व बधिर, H = शारीरिक रूप से विकलांग, S = स्पास्टिक C = डिस्लेक्सिक, A = ऑटिस्टिक B = Visually Impaired, D = Hearing Impaired, H = Physically Challenged S = Spastic, C = Dyslexic, A = Autistic								
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*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

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Section A

1. A = getting a rotten apple.
 $n(S) = 900$ - total apples
 $P(A) = 0.18$.

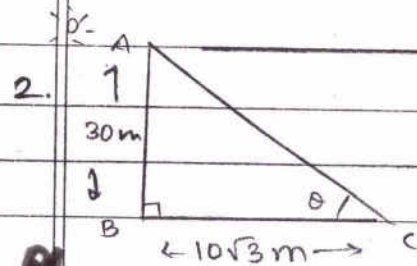
Let $n(A)$ be number of rotten apples.

Then,
$$P(A) = \frac{n(A)}{n(S)} = \frac{n(A)}{900}$$

$$0.18 \times 900 = n(A)$$

$$\therefore n(A) = 162$$

So, there are 162 rotten apples in the heap.



Tower AB is 30m and shadow BC is $10\sqrt{3}$ m
 In $\triangle ABC$ which is right triangle,

$$\tan \theta = \frac{AB}{BC} = \frac{30}{10\sqrt{3}}$$

$$\tan \theta = \sqrt{3}$$

but $\tan 60^\circ = \sqrt{3} \therefore \theta = 60^\circ$.

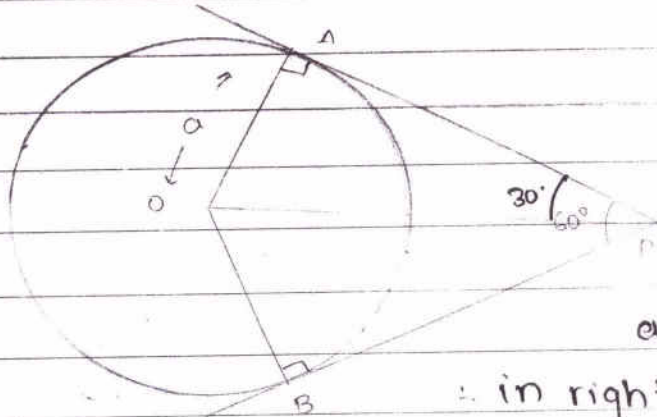
so, angle of elevation of sun is 60° .

$$\begin{array}{r} 18 \\ \times 9 \\ \hline 16200 \end{array}$$

$$\frac{162}{900} = \frac{18}{100}$$

$$\frac{30\sqrt{3} \times \sqrt{3}}{10\sqrt{3}}$$

3.



Tangents are equally inclined to line joining the external point P to centre O.

$$\therefore \angle APO = \angle BPO = \frac{60}{2} = 30^\circ$$

also radius \perp tangent at point of contact.

\therefore in right $\triangle OAP$, $\angle APO = 30^\circ$.

$$\text{Now } \sin 30^\circ = \frac{OA}{OP} = \frac{a}{OP}$$

$$\frac{1}{2} = \frac{a}{OP} \quad \therefore \text{radius} = a.$$

$$OP = 2a$$

4. Let a be 1st term and d be the common difference.

$$a_{21} - a_7 = 84$$

$$a + (21-1)d - [a + (7-1)d] = 84$$

$$a + 20d - a - 6d = 84$$

$$14d = 84$$

$$d = 6$$

\therefore common difference is 6.

Section D

21. The points A, B and C are collinear.

$\therefore A(\Delta ABC) = 0.$

Using area formula,

$x_1 = k+1, x_2 = 3k, x_3 = 5k-1$

$y_1 = 2k, y_2 = 2k+3, y_3 = 5k.$

Using area formula,

$x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0.$

$(k+1)(2k+3-5k) + 3k(5k-2k) + (5k-1)(2k-2k-3) = 0$

$(k+1)(3-3k) + 3k(3k) + (5k-1)(-3) = 0.$

~~$3(1+k)(1-k) + 3(k)(3k) - 3(5k-1) = 0.$~~

~~$3 [1 - k^2 + 3k^2 - 5k + 1] = 0.$~~

~~$2k^2 - 5k + 2 = 0$~~

~~$2k^2 - 4k - k + 2 = 0$~~

~~$2k(k-2) - 1(k-2) = 0$~~

$$\therefore (2k-1)(k-2) = 0$$

$$\therefore (k-2) = 0 \quad \text{or} \quad (2k-1) = 0$$

$$\therefore k = 2 \quad \text{or} \quad \frac{1}{2}$$

22. In $\triangle ABC$,

$$\angle A + \angle B + \angle C = 180^\circ \quad \text{— angle sum property,}$$

$$105^\circ + 45^\circ + \angle C = 180^\circ$$

$$\therefore \angle C = 30^\circ$$

Steps of construction:

1) Draw $BC = 7\text{cm}$ $\angle CBy = 45^\circ$ and $\angle BCz = 30^\circ$.

Let rays By and Cz intersect at A . $\triangle ABC$ is given.

2) From B draw a ray Bx below BC making acute angle with BC . Along it mark 4 points B_1, B_2, B_3, B_4 such that $BB_1 = B_1B_2 = \dots = B_3B_4$.

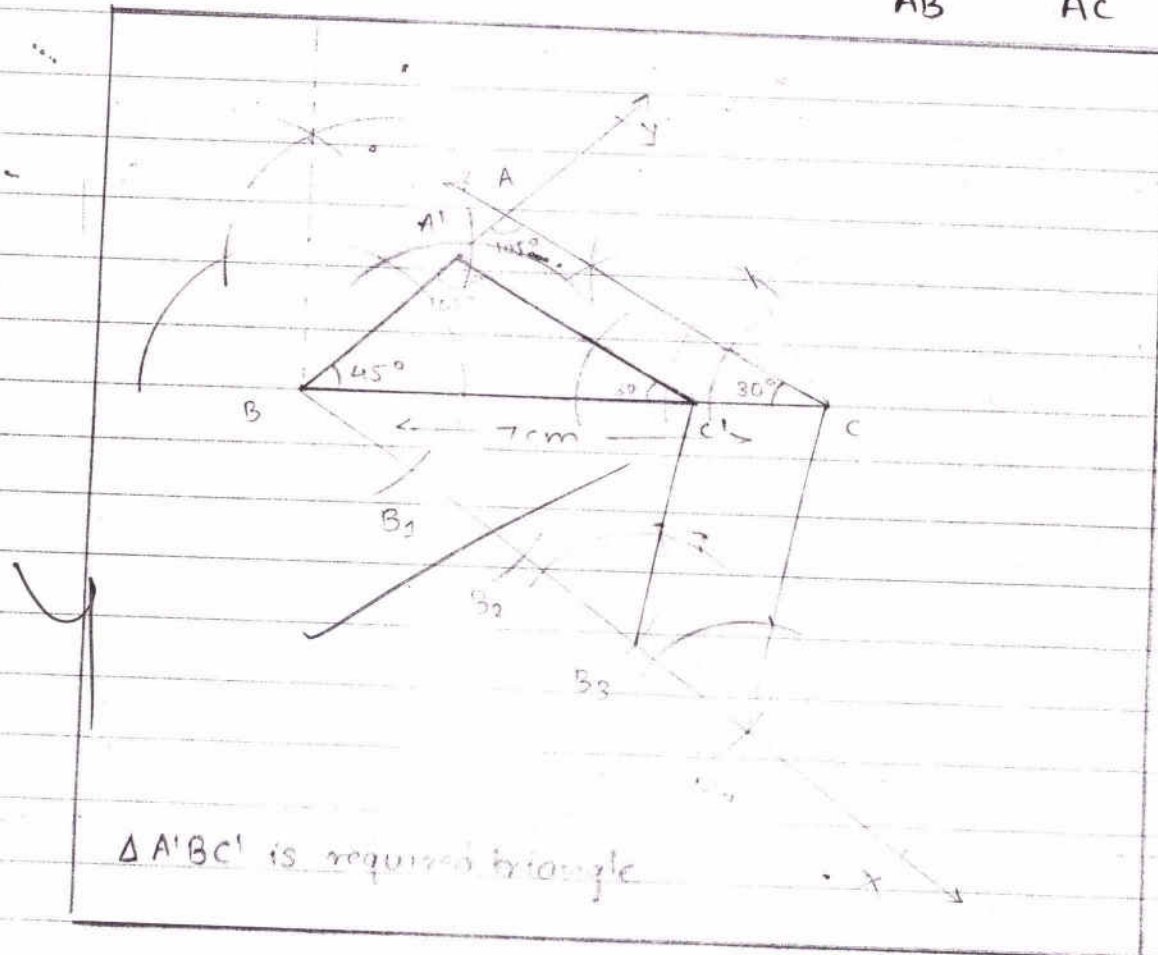
3) Join B_4C . Make $\angle BB_4C$ at B_3 such that the ray intersects BC at C' . $\therefore \angle BB_4C = \angle BB_3C'$.
So, $B_4C \parallel B_3C'$.

4) From C' make $\angle BC'A' = \angle BCA$ so that $C'A' \parallel CA$.
 $\triangle A'B'C'$ is the required triangle.

$$\begin{array}{r} 105 \\ 45 \\ \hline 150 \\ 105 \\ 45 \\ \hline 150 \\ 30 \\ \hline 180 \end{array}$$

Justification:

$\angle B = \angle B$ and $\angle BC'A' = \angle BCA$ - construction
 $\therefore \Delta A'B'C' \sim \Delta ABC$ by AA so, $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{B'C'}{BC} = \frac{3}{4}$



23.

i) A = sum of digits is even.- $n(S) = 6^2 = 36$. - total possible outcomes.

$$n(A) = \{ (1,3), (1,5), (1,1), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), \\ (4,2), (4,4), (4,6), (5,1), (5,3), (5,5), (6,2), (6,4), (6,6) \}$$

$$= 18.$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{18}{36}$$

$$= \frac{1}{2} \text{ or } 0.5$$

\therefore probability of getting an even sum is $\frac{1}{2}$ or 0.5.

ii) A = product of digits is even

$$n(S) = 36.$$

$$n(A) = \{ (1,2), (1,4), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), \\ (3,2), (3,4), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), \\ (5,2), (5,4), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \}$$

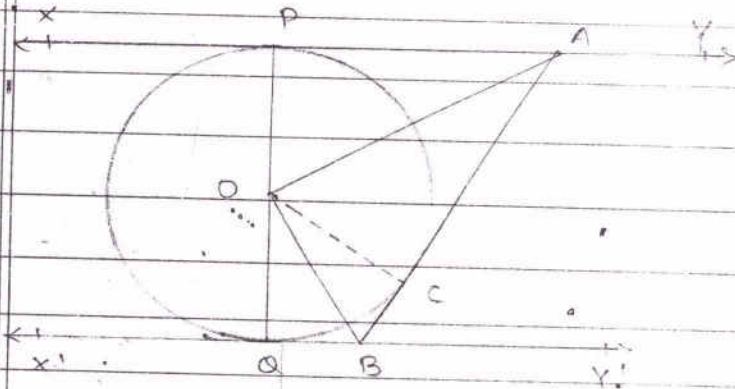
$$= 27$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{27}{36}$$

$$= \frac{3}{4} = 0.75$$

probability of getting even product is $\frac{3}{4}$ or 0.75.

24



Given: $XY \parallel X'Y'$ - tangents.

PQ is diameter, OC is radius.

Tangent ACB touches XY at A and $X'Y'$ at B .

To prove: $\angle AOB = 90^\circ$.

Proof: $XY \parallel X'Y'$ and AB is transversal.

$\therefore \angle XAB + \angle ABX' = 180^\circ$ - cointerior angles.
or $\angle PAB = \angle QBA$ — ①

It is known that tangents from a same point are equally inclined to the line joining centre to that point.

$\Rightarrow \angle PAO = \angle CAO$ and $\angle QBO = \angle CBO$

In ①,

$$2\angle CAD + 2\angle CBO = 180^\circ$$

$$\text{or } 2\angle BAO + 2\angle ABO = 180^\circ$$

$$\angle BAO + \angle ABO = 90^\circ \quad \text{--- ②}$$

In ΔAOB ,



$$\angle BAO + \angle ABO + \angle AOB = 180^\circ \quad \text{--- anglesum.}$$

$$\text{From ②, } 90^\circ + \angle AOB = 180^\circ$$

$$\therefore \angle AOB = 90^\circ$$

Hence, proved.

25. radius of cylindrical tank = $\frac{2}{2} = 1\text{m.}$

its height = $3.5\text{m.} = \frac{35}{10}\text{m}$

Let the height of water on roof be h .

Volume of water on roof = Volume of water in tank.

$$l \cdot b \cdot h = \pi r^2 h'$$

$$22 \times 20 \times h = \frac{22}{7} \times \frac{35}{10} \times \frac{35}{10} \times 1 \times 1$$

$$h = \frac{22}{2} \times \frac{1}{22} \times \frac{1}{20} = \frac{1}{40}\text{m}$$

$$22 \times 20 \times h = \frac{22 \times 35 \times 35}{7 \times 10 \times 2}$$

$$h = \frac{22 \times 1 \times 1}{2 \times 22 \times 20} = \frac{1}{40}$$

U

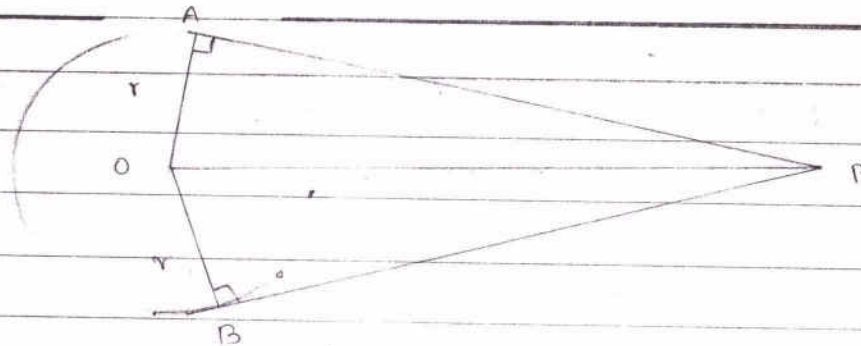
$$\therefore h = \frac{1}{40} \text{ m} = \frac{1}{40} \times 100 \text{ cm} \\ = 2.5 \text{ cm}$$

So, the rainfall is 2.5 cm

Views on water conservation:

- It is important practice in today's era of irrational water consumption and pollution. It should be practised at municipal level at all places.
- It can be done by many simple ways even at domestic level.
- Doing it is a sign of environmental consciousness.
- Some methods of water conservation are rooftop / surface water harvesting, building small earthen dams, etc.
- This conserved water helps refill underground water bodies and so, all must practise water conservation for sustainable development.

26



Given: Circle ~~with~~ $C(O, r)$

2 tangents from P at A and B

To prove: $AP = BP$

Construction: Join OA, OB and OP

Proof:

In $\triangle APO$ and $\triangle BPO$,

$OA = OB$ — radii of same circle.

$OP = OP$ — common side.

$\angle OAP = \angle OBP = 90^\circ$ — Radius is \perp tangent at point of contact.

by RHS criterion,

$\triangle APO \cong \triangle BPO$.

and hence, $AP = BP$ — by c.p.c.t.

\therefore lengths of 2 tangents drawn from an external point to a circle are equal.

27. Let a, d and A, D be the 1st term and common difference of the 2 APs respectively.

QUESTION

Then,

$$\frac{n}{2} [2a + (n-1)d] = \frac{7n+1}{4n+27}$$

$$\frac{n}{2} [2A + (n-1)D]$$

$$\frac{2a + (n-1)d}{2A + (n-1)D} = \frac{7n+1}{4n+27}$$

Replacing n by 17 in both LHS and RHS,

$$\frac{2a + (17-1)d}{2A + (17-1)D} = \frac{7(17)+1}{4(17)+27}$$

$$\frac{2a + 16d}{2A + 16D} = \frac{119+1}{68+27}$$

$$\frac{2(a+8d)}{2(A+8D)} = \frac{120}{95}$$

as $a + (n-1)d = a_n$,

$$\frac{a_9}{A_9} = \frac{24}{19}$$

\therefore ratio of 9th terms is 24:19

$$7(2m-1)+1$$

$$14m-7+1$$

$$14m-6$$

$$\cdot 120$$

$$\begin{array}{r} 120 \\ \times 19 \\ \hline 1080 \\ 2160 \\ \hline 2280 \end{array}$$

$$\begin{array}{r} 17 \\ \times 25 \\ \hline 85 \\ 340 \\ \hline 425 \end{array}$$

$$\begin{array}{r} 17 \\ \times 19 \\ \hline 153 \\ 1530 \\ \hline 323 \end{array}$$

$$4(2m-1)+27$$

$$8m-4+27$$

$$8m+23$$

$$\begin{array}{r} 72 \\ +23 \\ \hline 95 \end{array}$$

28. Let $\frac{x-1}{2x+1}$ be y ,

$$y + \frac{1}{y} = 2$$

$$y^2 + 1 = 2y$$

$$y^2 - 2y + 1 = 0$$

$$y^2 - y - y + 1 = 0$$

$$y(y-1) - 1(y-1) = 0$$

$$(y-1)(y-1) = 0$$

$$\therefore y = 1 \text{ or } 1.$$

Now, $\frac{x-1}{2x+1} = 1$

or $\frac{x-1}{2x+1} \geq 1$

$$x-1 = 2x+1$$

$$-2 = x$$

$$\therefore x = -2 \text{ or } -2$$

$$\therefore \boxed{x = -2}$$

29. Let B complete a work in x days.
 Then A takes $x-6$ days to complete it.
 Together they complete it in 4 days.
 According to work done per day,

$$\frac{1}{x-6} + \frac{1}{x} = \frac{1}{4}$$

$$\frac{x + x-6}{x(x-6)} = \frac{1}{4}$$

$$4(2x-6) = \cancel{x(x-6)}$$

$$8x - 24 = x^2 - 6x$$

$$\therefore x^2 - 14x + 24 = 0$$

$$x^2 - 12x - 2x + 24 = 0$$

$$x(x-12) - 2(x-12) = 0$$

$$(x-2)(x-12) = 0$$

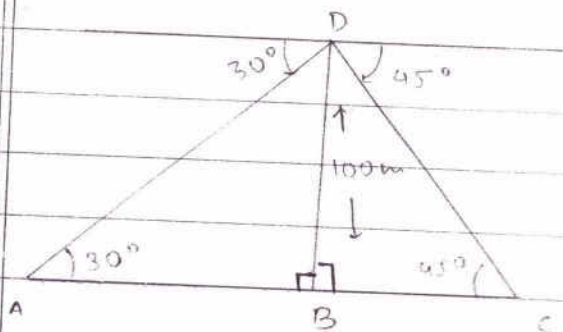
$$\therefore x = 2 \text{ or } 12.$$

$x=2$ is not possible because then $x-6$ is (-4)

$$\therefore x = 12.$$

So, B takes 12 days to finish the work.

30.



To find : AC

Solution:

In $\triangle ABD$, $\angle DAB = 30^\circ$

In $\triangle BDC$, $\angle BCD = 45^\circ$.

also, $BD = 100\text{m}$.

In right $\triangle ABD$,

$$\tan 30^\circ = \frac{DB}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{AB}$$

$$AB = 100\sqrt{3} = 100 \times 1.732 = 173.2\text{m}$$

In right $\triangle DBC$,

$$\tan 45^\circ = \frac{DB}{BC}$$

$$1 = \frac{100}{BC} \Rightarrow BC = 100\text{m}$$

Now, $AC = AB + BC = 100 + 173.2\text{m} = \underline{273.2\text{m}}$
 or $100(\sqrt{3} + 1)\text{m}$

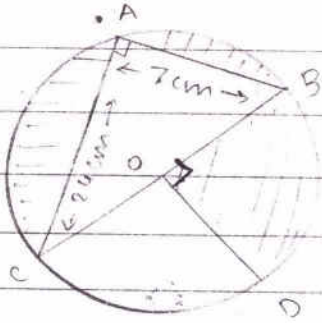
31.

Handwritten calculations for problem 31:

$$\begin{array}{r} 625 \\ \times 33 \\ \hline 1875 \\ 18750 \\ \hline 20625 \end{array}$$

$$\begin{array}{r} 11 \\ 3 \times 22 \times 625 - 1 \times 2 \times 7 \\ \times \\ 2 \quad 7 \quad 21 \quad 28 \\ \hline 5156.25 \\ \underline{20625} \\ 2578.125 \\ \underline{5156.25} \\ 2578.125 \\ \underline{2578.125} \\ 368.3035 \\ \underline{2578.125} \\ 368.3035 \\ \underline{42.000} \\ 326.3035 \\ \underline{42} \\ 284.3035 \end{array}$$

31.



$\angle CAB = 90^\circ =$ angle subtended by diameter.
in right $\triangle CAB$,

by pythagoras theorem,

$$AC^2 + AB^2 = BC^2$$

$$24^2 + 7^2 = BC^2$$

$$576 + 49 = BC^2$$

$$625 = BC^2 \quad \dots \quad \text{---(ignoring -ve value)}$$

$$\therefore BC = 25 \text{ cm.} = \text{diameter.}$$

$$\therefore \text{radius} = 12.5 \text{ cm or } \frac{25}{2} \text{ cm.}$$

area of shaded region = area of semicircle + area of quadrant - area of $\triangle ACB$

$$= \frac{2 \times 1}{2} \times \pi r^2 + \frac{1}{4} \times \pi r^2 - \frac{1}{2} \times AB \times AC$$

$$= \frac{3}{4} \pi r^2 - \frac{1}{2} \times 7 \times 24$$

$$= \frac{3}{4} \times \frac{11}{7} \times \frac{625}{4} - 7 \times 12$$

$$= 368.3035 - 84$$

$$= 284.3035$$

$$\approx 284.3 \text{ cm}^2$$

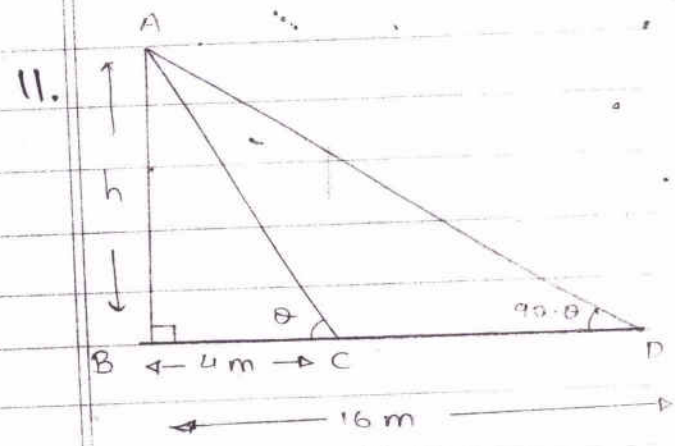
∴ The area of shaded region is
284.3035 cm²

$$\begin{array}{r} \sqrt{625} \\ \times 11 \\ \hline 625 \\ 625 \\ \hline 6875 \\ \times 2213 \\ \hline 20625 \end{array}$$

$$\begin{array}{r} 2578.125 \\ \underline{20625} \quad 10 \text{ } \\ 897 \end{array}$$

$$\begin{array}{r} 368.3035 \\ \underline{20625} \quad 40 \\ \hline \end{array}$$

$$\begin{array}{r} \nearrow \\ 16 \\ 368.3035 \\ \underline{84.0000} \\ \hline 284.3035 \end{array}$$



Section C

It is given that $\angle ACB$ and $\angle ADB$ are complementary.

Let them be θ and $90-\theta$ respectively.

Now,

In right ΔABC ,

$$\tan \theta = \frac{AB}{BC} = \frac{h}{4}$$

$$\tan \theta = \frac{h}{4} \quad \text{--- (1)}$$

In right ΔABD ,

$$\tan(90-\theta) = \frac{AB}{BD} = \frac{h}{16}$$

$$\cot \theta = \frac{h}{16}$$

$$\tan \theta = \frac{16}{h} \quad \text{--- (2)}$$

$$\tan(90-\theta) = \cot \theta$$

$$\cot \theta = \frac{1}{\tan \theta}$$

From ① and ②,

$$\tan \theta = \frac{h}{4} = \frac{16}{h}$$

$$h^2 = 4 \times 16$$

$$h = \sqrt{4 \times 16}$$

$$\therefore h = 2 \times 4$$

$$h = 8 \text{ m}$$

(ignoring -ve value)

\therefore height of tower is 8 m.

12. Let there be x black balls and 15 white balls.

$$\text{Total balls} = n(S) = 15 + x$$

$$P(\text{drawing black ball}) = 3 \times P(\text{drawing white ball}).$$

$$\Rightarrow \frac{x}{(15+x)}$$

$$x$$

$$x$$

$$= 3 \times \frac{15}{(15+x)}$$

$$= \frac{3 \times 15}{(15+x)} \times (15+x)$$

$$= 45$$

\therefore There are 45 black balls in the bag.

13. Area of shaded region = Area of semicircle with $r = 4.5$ cm
 + Area of semicircle with $d = 3$ cm
 - $2 \times$ area of semicircle with $d = 3$ cm
 - area of circle with $d = 4.5$ cm.

$$= \frac{1}{2} \times \pi \times (4.5)^2 + \left(\frac{1}{2} \times \pi \times \left(\frac{3}{2} \right)^2 \right) - 2 \times \left(\frac{1}{2} \times \pi \times \left(\frac{3}{2} \right)^2 \right) - \frac{\pi}{4} \times \left(\frac{4.5}{2} \right)^2$$

$$= \left(\frac{1}{2} \times \pi \times (4.5)^2 \right) +$$

$$= \frac{2 \times 1}{4} \times \pi \times 20.25 - \frac{\pi \times 9}{4} - \frac{\pi \times 20.25}{4}$$

$$= \frac{\pi}{4} \left[2 \times 20.25 - \frac{9}{2} - 20.25 \right]$$

$$= \frac{\pi}{4} \left[40.5 - 4.5 - 20.25 \right]$$

$$= \frac{\pi}{4} \left[20.25 - 4.5 \right]$$

$$= \frac{\pi}{4} (15.75)$$

$$\begin{array}{r} 40.5 \\ - 20.25 \\ \hline 20.25 \\ - 4.5 \\ \hline 15.75 \end{array}$$

$$= \frac{22}{7} \times 2.25$$

$$= \frac{2 \times 11 \times 2.25}{2}$$

$$= \frac{24.75}{2}$$

$$= 12.375 \text{ cm}^2$$

\therefore area of shaded region is 12.375 cm²

$$\begin{array}{r} 225 \\ 225 \\ \hline 2475 \end{array}$$

$$\begin{array}{r} 225 \\ 225 \\ \hline 2475 \end{array}$$

14.

$$P(2, -2) \quad Q\left(\frac{24}{11}, y\right) \quad R(3, 7)$$

using section formula,

$$\left(\frac{24}{11}, y\right) = \left(\frac{3m + 2n}{m+n}, \frac{7m - 2n}{m+n}\right) \quad \text{--- (1)}$$

$$\Rightarrow \frac{24}{11} = \frac{3m + 2n}{m+n}$$

$$24m + 24n = 33m + 22n$$

$$\begin{aligned} \text{Here } x_1 &= 2, \quad y_1 = -2 \\ x_2 &= 3, \quad y_2 = 7 \end{aligned}$$

$$\begin{array}{r} 2 \times 3 \\ 3 \times 2 \\ \hline 9 \end{array}$$

$$2n = 9m$$

$$\frac{2}{9} = \frac{m}{n}$$

∴ The given point divides the line segment in ratio 2:9.

Taking $m=2$ and $n=9$,

$$y = \frac{7m - 2n}{m+n} \quad (\text{from } \textcircled{1})$$

$$y = \frac{7(2) - 2(9)}{2+9}$$

$$y = \frac{14 - 18}{11}$$

$$y = \frac{-4}{11}$$

15. speed of water in canal = 25 km/hr.

$$\text{in 40 min} = \frac{40}{60} = \frac{2}{3} \text{ hr,}$$

$$\text{length of water} = 25 \times \frac{2}{3} = \frac{50}{3} \text{ km} = \frac{50000}{3} \text{ m}$$

volume of water in canal in 40 minutes = volume of water for irrigation.

$$\frac{18}{10} \times \frac{18}{10} \times \frac{50000}{3} \text{ m}^3 = \frac{10}{100} \times l \times b \text{ m}^3$$

$$324 \times 5000 = l \times b$$

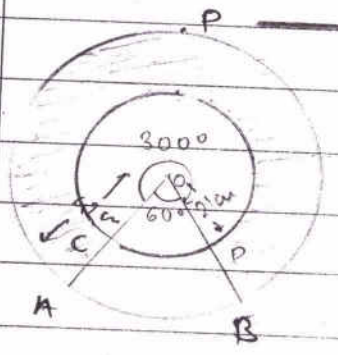
$$1620000 = l \times b$$

area irrigated in 40 minutes is 1620000 m²

$$= \frac{1620000}{1000000}$$

$$= 1.62 \text{ km}^2 \text{ or } 162 \text{ hectares.}$$

16.



$$\angle AOB = \angle COD = 60^\circ \quad R = 42 \text{ cm}, r = 21 \text{ cm.}$$

$$\therefore \text{reflex of } \angle AOB = 300^\circ = \theta \quad (360^\circ - 60^\circ)$$

Now,

area of shaded region

$$= \frac{\theta}{360^\circ} \times \pi R^2 - \frac{\theta}{360^\circ} \times \pi r^2$$

17.

$$= \frac{\theta}{360^\circ} \times \pi \times (R^2 - r^2)$$

$$= \frac{300^\circ}{360^\circ} \times \frac{22}{7} \times (42-21)(42+21)$$

$$= \frac{5}{6} \times \frac{22}{7} \times \cancel{21}^3 \times 63$$

$$= 5 \times 11 \times 63$$

$$= 3465 \text{ cm}^2$$

\therefore area of shaded region is 3465 cm^2 or 0.3465 m^2

$$\begin{array}{r} 63 \\ \times 59 \\ \hline 315 \\ 3150 \\ \hline 3465 \end{array}$$

17.

For the hollow cylindrical pipe,

$$r = 30 \text{ cm} \quad \text{and} \quad R = 30 + 5 = 35 \text{ cm.}$$

let its length be h .

volume of the 2 is same.

$$\therefore 44 \times 26 \times h =$$

$$4.4 \times 100 \times 2.6 \times 100 \times 100 = \pi h (R^2 - r^2)$$

$$440 \times 260 \times 100 = \frac{22}{7} \times h \times (35+30)(35-30)$$

$$440 \times 260 \times 100 = \frac{22}{7} \times h \times 65 \times 5$$

$$7 \times \frac{20}{22} \times \frac{4}{65} \times \frac{20}{5} \times 100 = h$$

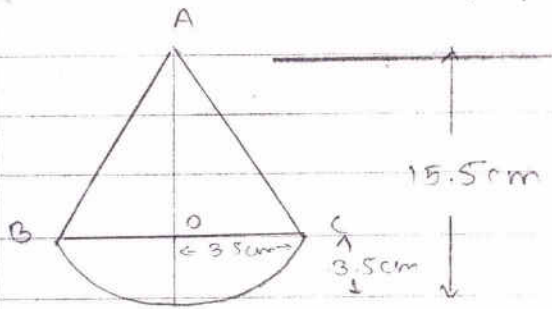


$$7 \times 20 \times 4 \times 20 = h$$

$$11200 = h$$

∴ pipe is 11200 cm or 112 m long

18.



Height of hemisphere = r = 3.5 cm

height of cone = 15.5 cm - 3.5 cm = 12 cm = h.

$$\begin{aligned} \text{Slant height of cone} &= \sqrt{r^2 + h^2} \\ &= \sqrt{12.25 + 144} \\ &= \sqrt{156.25} \\ &= 12.5 \text{ cm} \end{aligned}$$

$$\begin{array}{r} 65 \\ \times 24 \\ \hline 260 \end{array}$$

$$\begin{array}{r} 140 \\ \times 80 \\ \hline 11200 \end{array}$$

$$\begin{array}{r} \sqrt{156.25} \\ 12 \cdot 25 \\ \hline 156.25 \\ \hline 156.25 \\ \hline 0.00 \end{array}$$

$$\begin{array}{r} 2 \overline{) 156} \\ \underline{278} \\ 39 \\ \underline{39} \\ 0 \end{array}$$

TSA of toy = CSA of cone + CSA of hemisphere.

$$= \pi r l + 2\pi r^2$$

$$= \pi \frac{22}{7} \times 12.5 \times 3.5 + 2 \times \frac{22}{7} \times 3.5 \times 3.5$$

$$= 22 \times 12.5 \times 0.5 + 22 \times 3.5$$

$$= 22 \left(\frac{12.5 \times 5}{10} + 3.5 \right)$$

$$= 22 \left(\frac{12.5 \times 1}{2} + 3.5 \right)$$

$$= 22 (6.25 + 3.5)$$

$$= 22 (9.75)$$

$$= 214.5 \text{ cm}^2$$

\therefore Total surface area of toy is 214.5 cm^2

$$\begin{array}{r} 625 \\ 350 \\ \hline 975 \end{array}$$

$$\begin{array}{r} 975 \\ \times 112 \\ \hline 1950 \\ 1950 \\ \hline 21450 \end{array}$$

$$975$$

$$\times 112$$

$$\hline 1950$$

$$1950$$

$$\hline 21450$$

$$975$$

$$\times 112$$

$$\hline 1950$$

$$1950$$

$$\hline 21450$$

$$975$$

$$\times 112$$

$$\hline 1950$$

$$1950$$

$$\hline 21450$$

19.

$$a = 9, d = 8, S_n = 636.$$

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$636 = \frac{n}{2} [18 + (n-1)8]$$

$$636 = n [9 + (n-1)4]$$

$$636 = n (9 + 4n - 4)$$

$$636 = n (5 + 4n)$$

$$636 = 5n + 4n^2$$

$$4n^2 + 5n - 636 = 0$$

$$4n^2 + 53n - 48n - 636 = 0$$

$$n (4n + 5)$$

$$4n^2 - 48n + 53n - 636 = 0$$

$$4n(n-12) + 53(n-12) = 0$$

$$(4n+53)(n-12) = 0$$

$$\therefore n = \frac{-53}{4} \text{ or } 12.$$

as n is a natural number, $n = 12$

\therefore 12 terms are required to give sum 636.

$$\frac{17}{8}$$

20

$$\begin{array}{r} 3 \overline{) 636} \\ 2 \overline{) 212} \\ 2 \overline{) 106} \\ \quad 53 \end{array}$$

$$3 \times 2 \times 2 \times 53 \times 2 \times 2$$

20. $A = (a^2 + b^2)$, $B = -2(ac + bd)$, $C = (c^2 + d^2)$
 as roots are equal,

$$D = B^2 - 4AC = 0.$$

$$B^2 = 4AC$$

$$[-2(ac + bd)]^2 = 4(a^2 + b^2)(c^2 + d^2)$$

$$\cancel{4}(a^2c^2 + 2abcd + b^2d^2) = \cancel{4}(a^2c^2 + a^2d^2 + b^2c^2 + b^2d^2)$$

$$2abcd = a^2d^2 + b^2c^2$$

$$0 = a^2d^2 - 2abcd + b^2c^2$$

$$0 = (ad - bc)^2$$

$$0 = ad - bc,$$

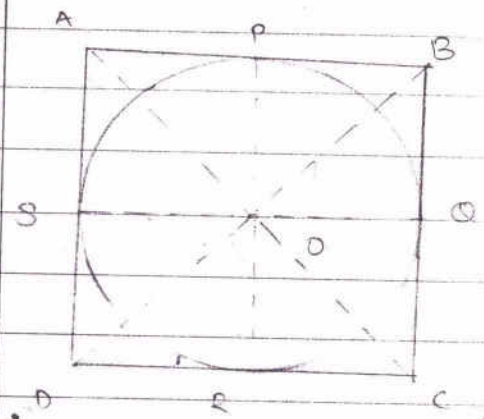
$$ad = bc.$$

$$\Rightarrow \begin{array}{|c|} \hline a \\ \hline b \\ \hline \end{array} = \begin{array}{|c|} \hline c \\ \hline d \\ \hline \end{array}$$

Hence, proved.

Section B

5.



Given : circle touching sides of ABCD at P, Q, R & S.

To prove: $AB + CD = AD + BC$.

Proof :

- AP = AS
- PB = BQ
- DR = DS
- CR = CQ

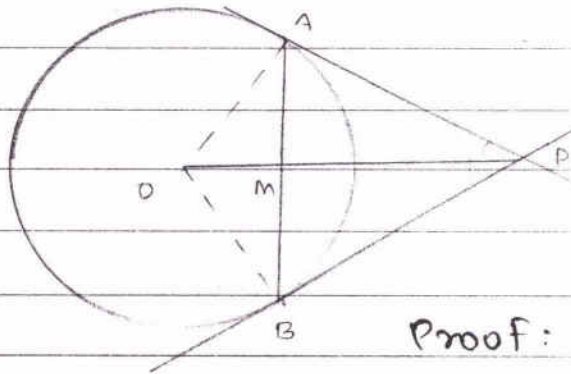
} tangents from same point to a circle are equal in length

adding all (1),

$$\begin{aligned}
 AP + PB + DR + CR &= AS + BQ + DS + CQ \\
 AB + CD &= AS + SD + BQ + QC \\
 AB + CD &= AD + BC
 \end{aligned}$$

Hence, proved.

6.



Given: chord AB.

tangents AP and BP at A & B

To prove: ~~AP = BP~~ $\angle PAM = \angle PBM$

Construction: Join centre O to P
let OP meet AB at M.

Proof:

In $\triangle AMP$ and $\triangle BMP$,

$AP = BP$ - tangents from same point to a circle are equal.

$MP = MP$ - common side

$\angle APM = \angle BPM$ - tangents are equally inclined to line joining the point of emergence to circle's centre.

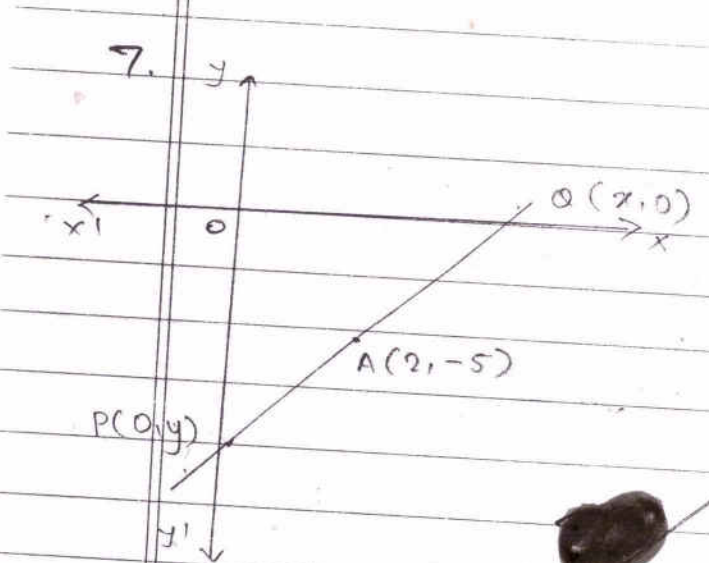
by SAS criterion,

$\triangle AMP \cong \triangle BMP$.

by cpct, $\angle PAM = \angle PBM$

Hence, tangents at endpoints of a chord make equal angles with it

TOP



Let coordinates of P be $(0, y)$ and of Q be $(x, 0)$.

$A(2, -5)$ is mid point of PQ.

by section formula,

$$(2, -5) = \left(\frac{0+x}{2}, \frac{y+0}{2} \right)$$

$$2 = \frac{x}{2} \quad \text{and} \quad -5 = \frac{y}{2}$$

$$\therefore x = 4 \quad \text{and} \quad y = -10.$$

$\therefore P$ is $(0, -10)$ and Q is $(4, 0)$

8.

$$PA = PB$$

$$\therefore PA^2 = PB^2$$

by distance formula,

$$(5-x)^2 + (1-y)^2 = (-1-x)^2 + (5-y)^2$$

$$\Rightarrow (5-x)^2 + (1-y)^2 = (1+x)^2 + (5-y)^2$$

$$25 - 10x + x^2 + 1 - 2y + y^2 = 1 + 2x + x^2 + 25 - 10y + y^2$$

$$-10x - 2y = 2x - 10y$$

$$8y = 12x$$

$$4(2y) = 4(3x)$$

$$\therefore 3x = 2y$$

Hence, proved.

9. Let α and β be the roots of given quadratic equation.

$$\beta = 6\alpha$$

Here, $a = p$, $b = -14$, $c = 8$.

$$\alpha + \beta = \frac{-(-14)}{p} = \frac{-b}{a}$$

$$7\alpha = \frac{14}{p}$$

$$\alpha = \frac{2}{p} \quad \text{--- (1)}$$

Also, $\alpha\beta = \frac{8}{p} = \frac{c}{a}$

$$\alpha \times 6\alpha = \frac{8}{p}$$

$$6x^2 = \frac{8}{p}$$

from (1),

$$6\left(\frac{2}{p}\right)^2 = \frac{8}{p}$$

$$6 \times \frac{4}{p^2} = \frac{8-2}{p}$$

$$\frac{6}{p^2} = \frac{2}{p}$$

$$\frac{63}{2} = \frac{p^2}{p}$$

$$\therefore p = 3$$

10. Let a, d and A, D be the 1st term and common difference of the 2 A.Ps respectively.
 n is same.

$$a = 63, \quad d = 2$$

$$A = 3, \quad d = 7$$

$$\begin{aligned}
 a_n &= A_n \\
 \Rightarrow a + (n-1)d &= A + (n-1)D \\
 63 + (n-1)2 &= 3 + (n-1)7 \\
 63 + 2n - 2 &= 3 + 7n - 7 \\
 61 + 2n &= 7n - 4 \\
 65 &= 5n \\
 13 &= n
 \end{aligned}$$

∴ When n is 13, the n^{th} terms are equal
 • i.e., $a_{13} = A_{13}$.

